DOCUMENT RESUME

ED 039 772 56 EM 008 108

AUTHOR	Ginther, John R.
TITLE	Technology, Philosophy and Education.
INSTITUTION	Academy for Educational Development, Inc., Washington, D.C.
SPONS AGENCY	Office of Education (DHEW), Washington, D.C. Bureau of Research.
BUREAU NO	BR-8-0571
PUB DATE	[70]
NOTE	36p.; This is one of the support papers for "To Improve Learning; a Report to the President and the Congress of the United States by the Commission on Instructional Technology", ED 034 905
EDRS PRICE	EDRS Price MF-$0.25 HC-$1.90
DESCRIPTORS	Bias, Changing Attitudes, *Educational Philosophy, *Instructional Technology, Program Descriptions

ABSTRACT

Education and schooling remain relatively unchanged even though there is much said about educational technology. In this paper the author examines the state of educational technology today and discusses some of the deterrents which have prevented the full use of educational technology. He notes the programs using educational technology which seem to have overcome some of the pitfalls. The increase in knowledge and in the demand for an increasing opportunity for participation in the development of decisions he sees as compelling reasons for reconsidering our educational patterns and the place of technology in them. A list of references is appended. (JY)

ED039772

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TECHNOLOGY, PHILOSOPHY AND EDUCATION

by

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Consideration of each of the terms in the title is undertaken in most sections of this paper. However, technology is discussed first so that a particular view of it can be used throughout. The limited amount of educational philosophy incorporated is treated in a different fashion. Examples and suggestions of tendencies toward philosophic positions are sprinkled throughout the paper in an effort to build a basis for a major generalization. In this paper education refers to various concrete meanings for the concepts content, method and purpose. Schooling, on the other hand, is reserved to indicate that standard patterns of activities stemming from the meanings are conventionally carried out in special buildings. However, conventional phrases make it difficult to maintain this distinction throughout.

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NO EDUCATIONAL TECHNOLOGY

Possibly the most striking feature of technology in education is that it has failed to establish a water-shed. The telescope replaced astrology with astronomy and altered irrevocably the history of man. The internal combustion engine forever changed transportation and the world of work. The assembly line revolutionized traditional ideas concerning the availability of goods to the population. The list of illustrations could be endless. Technology seems to change forever the style of that phase of man's life which is touched by it. But education and schooling remain relatively unchanged even though there is much said about "educational technology."

Educational Problems Not Addressed

The topic of Congressional hearings in 1966, "Technology in Education" (1), provides a clue to the mysterious immunity the process of educating our nation's children has had to change from the impact of technology. Historically technology has been viewed as the application of science to the problems of some area such as production, housekeeping, or transportation. The Congressional sub-committee avoided the error of suggesting there might be an "educational technology" by the wording of their topic. Not all the witnesses followed suit, and the usual list of devices and

objects were eventually suggested as being or representing educational technology. Such so-called educational technology typically fails the test of being addressed to an educational problem. Further, it beguiles the public which believes some educational problems have been addressed by "educational technology."

Miles of unused coaxial cable in school buildings, seldom used language laboratories, malfunctioning tape recorders, and motion picture projection equipment in various states of disrepair belie the belief that technology has been brought to bear on educational problems. If all the equipment alluded to were serving to alleviate serious educational problems there would be a storm of protest until the gadgetry were restored to full capability. But equipment, materials or gadgets bought in a faddish atmosphere seldom address an educational problem. Thus it seems ludicrous to even imagine that technology has been applied to education.

Stumbling Blocks

William James once wrote:

> You make a great, a very great mistake, if you think that psychology, being the science of the mind's laws, is something from which you can deduce definite programs and schemes and methods of instruction for immediate schoolroom use. Psychology is a science, and teaching is an art; and sciences never generate arts directly out of themselves. An intermediary inventive mind must make the application, by using its originality. (2)

Professor James suggests the fundamental reason for the failure to apply technology to education, for it would seem just as true in technology as in psychology that "an intermediary inventive mind must make the application." A recent report states that "the bearded intellectuals of the education companies and the button-down organization men of industry just aren't getting along" in "The Learning Business" and that business acumen "has proved not so easily transferred to the subtleties of education." (3) Perhaps the words of William James are appropriate even for the industries that would serve education today.

Peter Drucker has a slightly different view of the matter. It is his thesis that

> it is technologists who do not transfer, technologists who do not realize that they possess a discipline and a way of looking at work and tools. It is technologists who neglect to project their vision and their approach on the re-design of the tools and equipment mankind uses in its everyday pursuit. (4)

Let us attempt to transfer that idea to the culture of educational institutions. This would seem to suggest that it is not the teachers and administrators of educational institutions who reject technology; rather it is the technologist, failing to adapt his technology to the everyday work of this culture, who keeps the technology from having a massive impact on the culture. To some extent this is certainly true. For example, at one major institution of higher learning which prepares a complete range of

educational personnel from nursery school teachers through college presidents, it has been impossible to interest the department of education in using the computer to carry out routines such as student record keeping, bookkeeping, or storing mailing lists, and computer-assisted instructional procedures are beyond mention. This is not entirely because the faculty and staff are disinterested in or afraid of computers. Rather it stems from the fact that every time one of them is enticed to examine the use of computers he is frustrated by the necessity for learning a computer language; furthermore, he is typically confronted by a renegade mathematician whose presentation of the potential uses of computer terminals is both terse and abstract. After each of these encounters the faculty or staff involved quickly turns away from further consideration of the use of this particular tool. So far as these educators are concerned the technologists are saying "if you wish to use the technology, become a technologist." The educators seem to be thinking "when this gadget is easy to learn to use and when it is readily available to me, I may try it." And so, Drucker's hypothesis may have validity in the subculture of education. However, perhaps the problem posed permits more than one approach to solution. Perhaps an occasional technologist can be persuaded to adapt equipment to address some of the everyday problems

of educators. In addition, perhaps an occasional educator can be moved to develop a usable level of competence with the new tools and thus enable his profession to deal with the everyday problems via the technology. Either movement might help, but both would fall short of the approach suggested by Professor James' original contention.

The fact that there is no educational technology becomes more apparent as you consider the uses or applications of technology in other fields. Consider the queen of the arts, opera. There is no operatic technology, but certainly technology is applied in the production of opera. For example, at Lyric in Chicago radio replaces the familiar knock on the door to announce time until cue; hydraulic lifts in the basement are used by the stage crew to create basic floor designs for sets; closed circuit television is used to improve coordination of off-stage musicians with the pit orchestra and principals. In each instance it should be noted that Lyric overcame or alleviated some problem by the application of technology; for example, it is difficult to coordinate calls for "places" when dressing rooms are spread over several floors, halls tend to get congested, and two elevators service forty or fifty persons; radio, in this instance, simply cuts through the morass of difficulties.

Perhaps it is understandable that modern technology has failed to generate significant changes in education or schooling; it has not been addressed to educational problems. The suggested explanations for this state of affairs reveal obstacles. Unfortunately these are not the only difficulties ahead.

One Limited Use

. A review of the limited uses made of technology in education suggests that if any purpose has been put forward to be served it has been the transmission or conveyance of information. By far and away the most typical use of technology has been to provide students with information which they are not necessarily to use in any way but which they are to remember. Research journals are filled with endless studies from which one concludes that there are several equally useful ways to convey information for this purpose. Of course, the term "education" is used to cover a multitude of operations which have little to do with the instructional act, and technology has been put to somewhat more use on problems of scheduling and bookkeeping than on the problems of teaching and learning.

The point is that when we look upon the teaching-learning sector of "education" we find that technology has been applied to a limited extent to the problem of

transmitting information which is to be learned and remembered. Since it has been established that there are several equally effective ways to carry out this process it is understandable that a large group in the educational world raises their eyebrows when it is suggested that electronic computers be introduced into the educational scene; they feel that this is a very expensive way to move information to students who can apparently learn just as effectively from the lecture, and do it in larger groups. So as we explore technology applied to education, or perhaps technology not applied to education, we begin to see the underlying, prevailing view of the nature of method which, in turn, suggests a particular view of the nature of knowledge, if not the nature of mind. Later we will deal more directly with philosophic positions which touch on the nature of mind, method, and knowledge. Such views have direct implications for the problem of developing or applying technology to education.

DETERRENTS TO EDUCATIONAL TECHNOLOGY

If the difficulty forecast by Messrs. James and Drucker were to be overcome, the development of an educational technology might still be in doubt. There are feelings and attitudes abroad which suggest a tacky road for technology in education. The thrust of this affect

is motivated by fear of dehumanization and is aimed at mechanization of instruction as well as at infra-human views of the student in the educational process. These concerns will now be considered with rejoinders offerd occasionally. The topics, in order, will be: mechanization including automation and isolation from other humans; infra-human ideas, including mechanistic psychology in both instruction and testing.

Dehumanization: Mechanization

When a person is made to operate as though he were part of a machine it can be said that he has been automated, a form of mechanization. Being automated means that one loses degrees of freedom; for example, one is denied the opportunity to pace himself and is bound so closely to other operations that objections or deviations from the restricted pattern of performance raise risk, perhaps even peril. In an educational system a student can be locked into a course of study or an instructional program which is moved forward without regard for his feelings, comfort, understanding, interest, or anything else which might be called a human attribute. If this suggests classrooms with none of the hardware of technology, be dismayed but not surprised, for this kind of system is readily found in classrooms, particularly where it is believed that "we have to cover the material"

or where mastery of verbal material is the goal. But the great fear is that in the near future ideas like multi-media approaches to instruction would serve to automate the student by treating him as a cog which would move when a machine moved or a system dictated. However, the experience in Professor Postlethwait's multi-media learning laboratory for individualized instruction in biology at Purdue University suggests that large numbers of students do not resist or dislike their limited automated role in this learning situation. (5)

A different kind of concern is expressed by some who fear mechanization, especially by the computer, although their fear does extend to some extent to the whole range of technology. This fear is that the student will be dehumanized by additional, extended contact with technology because it will deprive him of that amount of interaction with human beings. To the extent that interaction with humans is humanizing, the argument is unassailable. But the question arises: to what extent is interaction with teachers humanizing? Professor Flanders has developed the following rule based on extensive observations of classrooms:

> In the average classroom, someone is talking two-thirds of the time. Two-thirds of the time the person who is talking is the teacher. Two-thirds of the time the teacher is talking he is using direct influence. (6)

"Direct influence" consists of: 1) Lecturing, 2) Giving directions, or 3) Criticizing or justifying authority. If this kind of activity is humanizing then the argument is still unassailable. If this approximately one-third of the classroom time which is spent in one-way communication is not necessarily humanizing, then perhaps the argument could be made that only part of this one-third of class time might be given over to the use of technology and we would not thereby be further dehumanizing students.

Another study raises some question about the firmness of the premise from which it is argued that technology removes students from the humanizing influence of teachers. Reporting on thirty taped hour sessions taken over ten day-long visitations another investigator came to the following conclusions:

1. These teachers dominated the oral activity, and were doing most of the work themselves.

2. By their methods of asking questions, the teachers encouraged guessing and slovenly habits of thought.

3. So many of the questions required only the use of memory to answer them, it indicates that memorization is of major significance, and could be the main goal of the instruction.

4. Teachers were acting as cross-examiners, relatively uninterested in the needs, interests, and capabilities of their pupils.

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> 5. These teachers seemed unaware of the psychology of oral questioning. Not only were they unskilled in the use of questions as an instructional instrument, they did not even seem to realize such a skill could be developed. (7)

If the above conclusions suggest humanizing activities, then the argument is still unassailable.

Study after study indicates that the encouragement of student verbal participation is the exception rather than the rule. When it is encouraged, the teacher either ignores or does not know how to use the student contributions as the basis for a conversation which might be used as part of the instructional act.

Those easily frightened by the hardware of technology might wish to examine the suggestion that normal, or ordinary classrooms harbor in an unorganized state certain phenomena suggestive of witch-hunts. In one out of twelve classrooms observed by Jules Henry the "witch-hunt syndrome was in full panoply." In the interest of further softening the charge that technology might dehumanize students by removing them from human interaction we should note:

> We see in the organization of the components of the witch-hunt syndrome an important phase in the formation of American national character, for tendencies to docility, competitiveness, confession, intra-group aggression, and feelings of vulnerability the children may bring with them to school, are reinforced in the classroom. This means that independence and courage to challenge are observably played <u>down</u> in these classrooms. (8)

We are, nevertheless, clearly and well advised to resist borrowing from time spent in beneficial human interaction and using it for the potentially mechanizing, thus dehumanizing act of automating students, and to resist isolating them via the use of technology. Meanwhile it would be useful for someone to investigate more thoroughly the humanizing effects of current school situations.

Sub-Human Students

As opposed to the mechanized view of dehumanization, there is the infra-human view. Those holding the latter view suggest that students are going to be taught more and more, and treated more and more as though they were sub-human. Although technology is probably not responsible for the appearance of mechanistic psychology or for the idea that a small corner of reinforcement theory ought to be applied to the process of education, it is true that mechanical devices and self-instructional materials do tend to be based on such a sub-human view of the student. (9) Part of the great anxiety about using B. F. Skinner's fraction of reinforcement theory (10) is that it is a powerful, potent tool likely to succeed in the goals set by persons who follow Skinner. In other words it is the power of this simple-minded approach which is so frightening. Clearly some process like that suggested by mechanistic psychology

does indeed operate in the human as well as in lower forms of animal life and it operates very effectively. In fact, exclusive attention to this level of human operation could lead to the point where other human potential would atrophy from disuse. Again, the concern expressed is that increased use of technology will lead to increased use of an infra-human view of learning theory as the basis for instructional practice.

The other point made by those who view education as dehumanizing because of the sub-human psychology used, is that the measurement of the outcomes of education are becoming more and more restrictive. We seem to be moving closer and closer to a measurement process which reflects the same kind of infra-human psychology which is reflected in the teaching-learning situation. Again, it is a little unfair to call this simply infra-human, for it does reflect a human potential although it is only a fraction of the potential that the human possesses. But the tests in courses tend to suggest not only what matter is important, but whether use is to be made of it. As a constricting measurement program is imposed, students restrict their efforts to fit the system.

Up to this point current cries of distress concerning the dehumanization of students have been suggested. As these are extrapolated, the technology, and

especially the computer, loom large as bogeymen to be avoided if not destroyed. These fears will now be addressed; first the fear that students will be so automated, so much a part of a system, that they will not have an opportunity to alter what is going on. Neither will they have, it is said, access to human teachers. Two countervailing examples are offered, examples of well established operations which suggest that the fears are based on a narrow view of what is happening and what might happen.

Hopeful Signs

The first example is a laboratory section of a linguistics course. In this laboratory students learn to use a string language for manipulating linguistic material in computers. At each meeting students receive a set of mimeographed information and a set of problems to be solved by using the new language in a computer program actually run in a computer. A stored program, which includes a variety of errors made by students, points out those errors actually committed by a particular student. These can then be corrected and the problem resubmitted. At each meeting the instructor asks whether or not students had difficulties they wish to discuss or questions to ask. When students initiate a discussion it is continued as long as necessary. The discussion concluded, or on days when there are

neither questions nor difficulties, a new set of materials is distributed and the routine cycled. Although this procedure automates students and reduces interaction with the teacher to zero some weeks, there seems to be no anxiety driving students to open pointless discussions just to interact, and many students seem to like the style of instruction provided. The fact is that individual students seem to have gained options under this kind of regime; a student needing help can obtain it, and a student successfully completing the standard tasks can simply drop by at the end of each meeting and pick up the new materials. Postlethwait's work, mentioned earlier, also suggests that students operate with success and satisfaction in an environment characterizable as dehumanizing on the criteria of automation and isolation from human interaction.

The fact is that a useful range of educational environments, some under control of a live teacher, others directed entirely by instructional materials, has been hypothesized. (11) The resulting model for developing instructional environments has proved valuable in organizing massive amounts of research on instruction (12); it has also led to a controlled study indicating that students of different personality types seem to prefer different styles of instruction. (13)

A few words are in order with regard to the belief that

infra-human learning theory will dominate the educational materials and procedures issuing from the application of technology to educational problems. Here we speak primarily of computers and systems dependent on computers, for this is the area usually singled-out for abuse.

Men doing advanced research on computers are using models developed or suggested by the writings of well known psychologists, psychiatrists, biologists and physiologists. For example the last chapter of Freud's Interpretation of Dreams as well as some of Piaget's work on the developing intelligence of children are among the works which suggest to students of artificial intelligence that the use of models inside the system is a useful concept. Such a concept has already been used in studies of stabilizing perception, adaptive control systems to produce simple motor responses, in chess games to avoid extensive search of a very large tree of possible moves, and elsewhere. (14) All of these suggest to Professor Greene that perception involves a synthesizing out of your elements. This could hardly stem from the same view of mind as that apparently held by persons who were ecstatic about using linear programs for instructional purposes. The black box of stimulus-response psychology has been invaded (15) and the result is the development of theories about cognitive operations. As in so many other areas of technology, the

greatest steps forward in pattern recognition by machine are being made on the basis of theories about human pattern recognition, theories which are plausible but obviously too simple-minded to account for more than a facet of the process carried on by the human. It is difficult to believe that anyone familiar with current work in cognitive psychology or on pattern recognition and artificial intelligence would be led to impose linear programming on students.

There are, then, formidable bases for objections and obstructions to the development of educational technology. Some of these can be dealt with by extending the information available to the objectors. Others need to be subjected to investigation and contrasted with situations dominated by human teachers. Only then will we have a clear, sound basis for making decisions about the development of educational technology.

PHILOSOPHY AND TECHNOLOGY

The review of reasons for our failure to apply technology to the problems of education has only touched on philosophic problems. Now we turn to a fuller view of what seem to be the educational issues reflecting philosophic positions; issues brought into focus by recent discussions of the potential of technology in education.

Variable Intellectual Initiative

As one reads the report of the Carnegie Commission on Educational Television, (16), it seems clear that this Commission had a static view of the learner or the recipient of television broadcasting in mind. There are to be more stations, an attempt to improve the quality of television, and an attempt to provide wider educational programming, etc., but the Commission seems to have failed to consider the student in educational television as a dynamic person who might want to participate in the educational programming. In terms of the Ginther model, (11), there is to be no opportunity for the student to become involved in the programming to the extent of altering the progress of instruction as it is presented or unfolded; his degrees of freedom are severely limited. Fortunately, among the supplementary papers in the Carnegie volume is one by J. C. R. Licklider writing on "Televistas: Looking Ahead Through Side Windows." Mr. Licklider deals with what he refers to as "interactive" and "selective" television as well as "narrowcast" as contrasted with the more conventional term "broadcast." Although Mr. Licklider proports to agree with B. F. Skinner's position about learning, his insistance upon interaction which permits the viewer or student to ask questions and otherwise participate in the selection and arrangement of materials to be used in the learning, belies

his addiction to Skinner's views and suggests a somewhat broader use of the concepts available in reinforcement theory. When one considers Mr. Licklider's views of the possible activities of the typical television viewer who is about to watch the evening news at home, one sees that the future of technology is, in part, to extend our concept of educational method.

This forward look at the uses and forms of technology, a look which promises that the student will have undreamed of opportunities to become involved in the creation of his own learning situations, strikes a familiar cord. A report from the Center for the Study of Democratic Institutions suggests the general concept applicable here to technology in education.

> ... if the building trades were to be automated, it would not mean inventing machines to do the various tasks now done by men; rather, buildings would be redesigned so that they could be built by machines. One might invent an automatic bricklayer, but it is more likely that housing would be designed so that bricks would not be layed. (17)

If new technology can suggest new methods, how shortsighted to use it merely to routinize old methods; and how fruitless to bring routinized old methods to bear on new problems and challenges, particularly when doing so clouds the real potential of technology. Students at all levels of our educational system are different today than they were even ten years ago because of the impact of technology

in conveying information rapidly to the general public. We indeed live in the electric age. To the extent that this suggests that students need a different approach in the teaching-learning situation, we ought to be prepared to use technology to create something different. For example, one should be willing to try manipulating the richness of the environment for the learner so that the easily overwhelmed student might receive a low amount of potential stimulation while some students might be placed in a saturated educational environment. It may be that such diverse kinds of situations would be appropriate at different times for the same individual student. Mr. Michael reminds us that the use of technology should enable us to deal with current educational problems and difficulties in new rather than old ways, and Mr. Licklider provides concrete images of exciting possibilities. It does seem disappointing to read in 1968 that nearly one-and-a-half million dollars is spent by a high school to install an "automated library" which consists primarily of audio-tapes of printed material and which "features" the opportunity for teachers to record their lectures so they will be available to students for "individual instruction." (18)

One thing the computer phase of technology makes potentially feasible is the application of John Dewey's notion that thinking always starts with some kind of difficulty

or problem or unresolved situation. It was his contention that education therefore started in such situations. Aside from the fact that some people did not like his brand of philosophy, this idea didn't get moving because of the fact that when students dealt with problems they sooner or later were confronted with situations which involved skills which took time to develop; or the situation required them to use information which they did not have at their command. The amount of time required to develop the skill or to command the information was usually sufficient so that the motivating force of the original situation would be dissipated before the skill or the command of information could be accomplished. The current technology, especially that which is assisted by the computer, makes it seem reasonable to reconsider Dewey's proposition. We now seem to be approaching the time when the necessary information could be made available in such short order that the student would be able to make use of it before motivation sagged. Depending upon the nature of the skill required, the student might also be in a better position today to develop the skill. To date a highly successful application of technology has been in skill training. Substitution for some skills is also possible today. For example, mathematical calculation need present no difficulty at all these days, for almost anyone can turn to a computer and have nearly any kind of

mathematical calculation done as quickly as he can enter the data. The entire problem of dissipating interest while standing still to develop skill or to command information has not evaporated, but it has become much more manageable so that it would now be possible to reconsider Dewey's notions particularly as they bear on motivation and method.

Turning to the ideas of Whitehead, one might profitably heed Harold Dunkel's suggestion that "Whitehead's greatest contribution to modern education possibly lies in the number of points at which he can serve as a needed corrective to certain tendencies in current American education and in contemporary American society." (19) In a sharply focused article Professor Dunkel suggests that one improvement would consist of reintroducing the romance phase of the learning cycle into schooling. (20) There would be a revolution in American education if just this idea were to be followed. For example, if computer technology could be used simply to advise students of a range of books, pictures, magazine articles, film strips, recordings, or motion pictures which were readily available on some topic, we would be able to enhance exploration in depth during self-motivated study or investigation. The potential of the computer as a component in the instructional situation is also to be considered. For example, a computer program would permit the student to make an ecological study

of colonies of bacteria in the human body. Via simulation he might suggest the numbers of bacteria, white blood cells, and chemical agents, as well as the conditions. Perhaps this suggests how an expanding array of potentially exciting situations might be used to develop understanding of difficult concepts at Whitehead's "precision" level. But the focus and the kind of change of emphasis which technology could help us create and which is badly needed on the American educational scene is the emphasis on the romance phase of Whitehead's rhythms of learning.

Conceptualism

The usefulness of technology in conveying information would enable us to develop a new philosophic framework at least as an alternative to if not a protagonist of realism. The reference is to conceptualism as a point of view which is, on the one hand, not widely held formally by educators in this country and, on the other hand, is a philosophic position which is extremely difficult to translate into an educational program. The problem seems to be that no matter how you devise methodology or materials of instruction, the view of the world and matter and knowledge turns out to sound like it was based on realism. Perhaps the speed with which sets of alternatives could be provided via the computer would be useful in developing a corrective or an alternative to this situation. Perhaps this phase of

technology would enable us to create situations in which the learner was not led to believe that realism was the only position available. There are some suggestions that this kind of major shift in emphasis on philosophic positions is near because of the availability of computer technology which might be turned to the problems of education.

Another suggestion basic to the application of technology to education is that the computer be thought of as a concept rather than a thing. Elsewhere I have attempted to persuade that "library" is a concept which has held and still holds a variety of meanings for teachers and librarians, and consequently takes a variety of forms and serves a range of functions. (21, 22) Similarly a computer can be thought of as a concept. The sooner this is done the sooner we may develop creative and useful ideas based on educational problems and capable of challenging the potential of computers in the educational process. The educator's conception of the computer will mold the uses made of it. It has already been suggested that technology has been viewed primarily as a means for transporting or presenting information to students, and this view has been extended to the computer. By way of contrast let us examine some recent applications of computers to instructional problems, imaginative applications stemming from consideration of the computer as a concept.

Starting with the complex problem of arranging for students to gain experience in the design of electrical circuitry or complex electrical jobs, two investigators devised a computer program which enables students to engage in creative design. The program also permits thorough testing of the designs. With this particular use of the computer "in the nine weeks session fifteen different designs, some of considerable sophistication, were built, modified, and tested." (23) Games have become a method for instructing in business management where intangible concepts such as planning and control and organization are deemed important. (24) The valid sorting of essays into "good", "poor", and those in between by means of a computer program has been demonstrated. (25) At the medical school at Case Western Reserve University a computer program, capable of bringing new pages of an interview schedule or stored data almost instantly at the touch of a hand on a cathode ray tube, is revolutionizing beliefs about the amount of information which can be summarized and used in developing an understanding of a patient's condition. Application of this idea to the problem of daily, if not continuous evaluation of the progress of students seems highly promising. These examples remind one of the statement that "speed-up of information ideally permits education to proceed by discovery and by pattern

recognition rather than by instruction in classified data." (26) But note that the specific programs and uses are directed toward the solution of particular problems, and require that the authors have a relatively unfettered notion of the computer as a concept. This seems to free the imagination to give meaning to the computer.

COMPELLING CONSIDERATIONS

There are a number of activities abroad in the land which suggest that there may be compelling reasons for thinking seriously about using the potentials of technology in our educational system. These will be considered here with full sensitivity to the suggested dangers of dehumanizing students mentioned earlier. There is no conscious attempt to order these in any particular way.

One observable movement is the tendency for Americans to create an ever enlarging body of ideas classifiable as believable rather than really true. Even church groups are shifting many teachings into a contingent, bound-by-circumstances category, teachings which formerly were believed to be true absolutely and without qualification. This suggests that even if the schools are to play their historic role of supporting the belief system of the culture they will have to change. And perhaps it is worth repeating the contention that one of the most difficult

tasks in teaching is to avoid the illusion that everything is based on a philosophic system of realism; difficult, that is, if undertaken. Yet we are urged to consider operating from a conceptualistic base.

> ... the child's conception of reality or meaning, however devient it may be from the adult educator's, must be respected. The child should not be told he is "wrong," for this will suggest to him that there is a "right." On the other hand, the child must not be left to himself to think that his way of thinking is the only one, or that he has ever achieved the most fruitful conception he can reach. It will be the task of a sensitive teacher to strike a balance between these by guiding the child through and to those experiences which the adult, from his own greater range of experiences combined with his empathy with the child, can select as potentially profitable for the child's development. This will demand more individualized instruction, and less concern with standardized achievement of prescriptive what-is-to-be-known. (27)

Simulations providing study of phenomena under shifting circumstances and the presentation of differing points of view through high speed delivery of relevant information are two potentials of technology which could serve the need to suggest a conceptualistic approach to some instruction.

A second noticeable phenomenon in American society is the demand for an increasing opportunity for participation in the development of decisions. This phenomenon yields two avenues of thought regarding technology, and particularly the computer. One avenue leads to the fact that citizens will have to learn how to make use of information which can be made available. Since nothing short of our new technology will approximate it in power and speed,

we are obligated to use the technology simply to prepare citizens to use it. Such preparation surely will involve a range of established scholarship such as external and internal criticism of documents, although perhaps in modern dress since a document might now be a message on a cathode ray tube. The second avenue leads to the realization that citizens are not prepared emotionally to participate in discussions basic to decisions responsive to social demands. This suggests that the efforts of social psychologists to train students for and habituate them to the use of group processes be redoubled--surely an unexpected outcome of the impact of technology.

Still another set of activities in American society which compels thoughtful consideration of technology in education is that set consisting of disruptions of schooling. It is a clearly established fact that students, teachers and parents can, have, and apparently will continue to close schools for essentially non-educational reasons. Perhaps we should be prepared for the abolishment of schools or for significant alterations in them to accomodate essentially community-problem oriented activities. Either contingency might be accompanied by the shifting of some form of conventional studies to a technologically based operation.

Some who believe that we are moving to a society based on a sophisticated technology also fear that the world cannot, under the attendant circumstances, exist as a coherent society unless a number of basic problems are solved. As has been suggested, life is simply different in the electric age. If the problems are to be solved we "will have to generate beliefs, behavior, and goals far different from those which we have held until now and which are driving us more and more inexorably into a contradictory world." (17)

We should not be surprised that compelling reasons have arisen for reconsidering our educational patterns and the place of technology in them.

> Electric speeds of information movement of themselves act as the new structuring forces as much in science and the arts as in politics and in entertainment ... Coexistence in space assumes a different character when it is also coexistent in time. Many of the arrangements made for spacial coexistence become embarrassing and irrelevant when instantaneous information exchange intrudes. That is to say that almost all of the existing arrangements in the educational establishment, for example, must seem bizarre to any young person today. Growing up in a world where all data and events appear integrally related, the student enters the educational establishment where instruction is in the main provided by means of classified data and separate subjects. (26)

Unfortunately, compelling reasons are on an elastic scale which often permits us to wait for entirely too much data before taking corrective action. It seems always that several persons must be killed before barriers are erected

at railroad crossings; numerous accidents must occur before a highway is straightened or a curve banked; murders must be committed before usury is investigated in business transactions; lives must be lost before health and safety codes are enforced in rental properties. Certainly there is reason to believe that compelling reasons for planning how to use the potential of technology in education will be ignored for the present. Perhaps the excitement of entertaining new methods of instruction or of developing conceptualism as a viable alternative to realism or of reintroducing romance in education will motivate continued thought for the time being.

THE CHARGE: CHALLENGE TECHNOLOGY

If we are to develop an educational technology, that is if we are to examine the range of problems which teachers confront, consider the potential of present technology and attempt to apply this potential to the problems in imaginative ways, we will probably have to move in unconsciously familiar yet "new" ways. Unconsciously, while a student, one who later becomes a teacher accepts or rejects instructional methods, materials and routines and in a very real sense learns to teach as he is taught. Unfortunately we standardize a particular subset of these variables and try to have all prospective teachers learn

this same subset consciously. We need to recognize the unconscious element in the development of teaching style and use it in efforts to promote, develop and test the application of technology to education. We need to provide opportunities for teachers in training as well as established teachers to use technology in their own education, training or retraining. In other words we need to create one or more places where learning theory beyond a mechanistic level would be used in the education of teachers, not only to guide the application of technology, but also to suggest appropriate limits to the use of such technology; where Whitehead's romance and precision levels might be used as the basis for part of the education of teachers, that is, as guides to the developing technology which they, as students, commanded; where technology would be tested, by teachers-become-students, to determine its potential for providing instruction based on conceptualism as an alternative to realism. In short, our charge must be to challenge technology taking account of William James' warning of the need for creative minds to intervene. But we must also test the results issuing from the challenge, designing the applications for use first with teachers in their own developing pattern of education and training. And we must be sensitive to the cautions from humanists as well as alert to the

beckonings of scientists who suggest ever more about the magnificant workings of both conscious and unconscious mind.

Finally, we must consider the possibility that we are in an era characterized by a new perspective on the nature of reality and, consequently, the nature and purpose of schooling and education. We must, then, extend our notion of the parameter of problems to which technology might be applied. There are several forces, some rational, which suggest that schools will one day be recognized as a concept with yet unimagined meanings. Technology is such a force; at the same time it is a tool which may be advantageously used to deal with currently unmanageable educational problems as well as with the dreams of those who believe that an extended view of the nature of mind, method, motivation and reality should be considered and tested in our educational system.

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